DUGWAY PERMIT

MODULE VII

ATTACHMENT 3

HWMU 2
POST-CLOSURE PLAN

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ABP	Agent Breakdown Product
ADR	Automated Data Review
ADRC	Automatic Data Review Contractor
AEC	Army Environmental Center
AGEISS	AGEISS Environmental
APCL	Applied Physics and Chemistry Laboratory
bgs	below ground surface
CAD	Computer-Aided Design
CCA	Comprehensive Certificate of Analysis
CCB	Continuing Calibration Blanks
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF	Calibration Factor
CFR	Code of Federal Regulations
CGWMP	Comprehensive Groundwater Monitoring Plan
CHWSF	Central Hazardous Waste Storage Facility
CLAA	Chloroacetic Acid
CLP	Contract Laboratory Program
CO	Contracting Officer
COC	Chain-of-Custody
COPC	Chemical of Potential Concern
CPT	Cone Penetrometer Testing
CQC	Contractor Quality Control
CRL	Contract Reporting Limit
CRQL	Contract Required Quantitation Limit
CVAAS	Cold Vapor Atomic Absorption Spectrometry
DBMS	Database Management System
DEP	Directorate of Environmental Programs Office
DEQ	Department of Environmental Quality
DFW	Definable Feature of Work
DIMP	Disopropylmethylphosphonate
DITF	Drum Inventory and Tracking Forms
DMMP	Dimethylmethylphosphonate
DMP	Data Management Plan
DNAPL	Dense Nonaqueous Phase Liquid
DOD	Department of Defense
DOT	U.S. Department of Transportation
Dugway	Dugway Proving Ground
DQO	Data Quality Objective
DSHW	Division of Solid and Hazardous Waste
EDD	Electronic Data Deliverable
EDL	Estimated Detection Limit
EMPA	Ethylmethylphosphonic Acid

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Continued)

ERPIMS	Environmental Resources Program Information Management System
ESRI	Environmental Systems Research Institute
FID	Flame Ionization Detector
FLAA	Fluoroacetic Acid
FPD	Flame Photometric Detector
ft/day	feet per day
FWEC	Foster Wheeler Environmental Corporation
FWV	Field Work Variance
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	Geographical Information System
GWM WP&SAP	Groundwater Monitoring Work Plan & Sampling and Analysis Plan
HCN	Hydrocyanic Acid
HNO_3	Nitric Acid
HPLC	High Performance Liquid Chromatography
HTRW	Hazardous Toxic and Radioactive Waste
HWMU	Hazardous Waste Management Unit
HWTS	Hazardous Waste Tracking System
ICB	Initial Calibration Blank
ICF Kaiser	ICF Kaiser Engineers
ICP	Inductive Coupled Plasma
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IDW	Investigation-Derived Waste
IMPA	Isopropylmethylphosphonic Acid
IRDMIS	Installation Restoration Data Management Information System
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LNAPL	Light Nonaqueous Phase Liquid
LUTP	Post-Closure Land Use Tracking Plan
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
µL	microliter
MeV	Million electron volt
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MP	Measurement Point
MPA	Methylphosphonic Acid
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSA	Method of Standard Additions

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Continued)

MSDS	Material Safety Data Sheet
msl	Mean Sea Level
NaOH	Sodium Hydroxide
NAPL	Non-Aqueous Phase Liquid
NFG	National Functional Guideline
nm	Nanometer
NTU	Nephelometric Turbidity Unit
OP	Operating Procedure
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxin
PCDF	Polychlorinated Dibenzofuran
PCP	Post-Closure Plan
PES	Parsons Engineering Science
POC	Point-of-Contact
PPE	Personal Protective Equipment
ppq	part per quadrillion
ppt	part per trillion
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QC	Quality Control
QCSM	Quality Control System Manager
QCSR	Quality Control Summary Report
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RRF	Relative Response Factor
RRL	Recommended Reporting Limit
RSD	Relative Standard Deviation
S/N	Signal-to-noise
SBV	Site Background Value
SD	Sample Duplicate
SFAR	Semiannual Field Activity Report
Shaw	Shaw Environmental, Inc.
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Continued)

TDL	Target Detection Limit
TDS	Total Dissolved Solids
TERC	Total Environmental Restoration Contract
TOC	Total Organic Compound
TOX	Total Organic Halide
TP&DCQAP	Technical Plan and Data Collection Quality Assurance Plan
TPH	Total Petroleum Hydrocarbon
TSD	Treatment, Storage, and Disposal
TSDF	Treatment, Storage, and Disposal Facility
TSS	Total Suspended Solid
UAC	Utah Administrative Code
UDEQ	Utah Department of Environmental Quality
UDSHW	Utah Division of Solid and Hazardous Waste
UHWMR	Utah Hazardous Waste Management Rule
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
UXO	Unexploded Ordnance
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WMA	Waste Management Area

1.0. INTRODUCTION

The objective of this Post-Closure Plan (PCP) is to ensure that Dugway complies with the Post-Closure Permit issued by the State of Utah in accordance with 40 Code of Federal Regulations (CFR) 265.117, with respect to post-closure inspections, care, and groundwater monitoring. To meet this objective, this Post-Closure Plan provides detailed information regarding the location, regulatory criteria, inspections, post-closure care and maintenance, and regulatory requirements for monitoring, sampling, and analysis of groundwater monitoring wells located at HWMU 2. Post-closure care will ensure that the engineered soil cover at HWMU 2 is maintained and functions as designed. Post-closure care will continue for a minimum of 30 years after closure of HWMU 2. The post-closure care period may be extended or shortened, as deemed necessary (40 CFR 265.117(a)(2)).

Technical personnel conducting post-closure activities will be qualified personnel capable of performing the duties identified in this Post-Closure Plan and shall be in compliance with Permit Condition VII.L. Additionally, personnel who perform intrusive activities and handle potential hazardous wastes (trench waste or contaminated groundwater) will be certified to conduct field work at hazardous waste sites as specified in 40 CFR 1910.120. Qualifications for the analytical laboratory include certification by the State of Utah, assessment of compliance under the requirements of the Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories, Final Version 2, June 2002, or most current version, and the ability to analyze groundwater samples for the suite of analytical parameters that are specified in this Post-Closure Plan.

In accordance with 40 CFR 270.28 and UAC R315-3-2.19, the post-closure permit is required to include specific information for a closed facility. As applicable to HWMU 2, the information requirements include:

1. General description of the facility;
2. Description of security procedures;
3. Copy of general inspection schedule;
4. Preparedness and Prevention Plan;
5. Facility location information
6. Closure Plan or Closure Proposal;
7. Certificate of Closure;
8. Topographic map, with specific scale;
9. Summary of groundwater monitoring data;
10. Identification of uppermost aquifer and interconnected aquifers; and
11. Detailed plans for groundwater monitoring program; with specific wells and constituents, proposed sampling, and corrective actions.

Table 1-1 provides the regulatory citations for the general information requirements and the specific locations in the Attachments or in the Post-Closure Plan where the specific information is presented.

Table 1-1: Summary of HWMU 2 Post-Closure Information Requirements Under 40 CFR 270.14 and UAC R315-3-2.19 and R315-3.2.5

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR 270.14(b)(1) UAC R315-3.2.5(b)(1)	General Description of the Facility	Post Closure Permit, Attachment 1
40 CFR 270.14(b)(4) UAC R315-3.2.5(b)(4)	Description of Security Procedures	Section 3.0.
40 CFR 270.14(b)(5) UAC R315-3.2.5(b)(5)	General Inspection Schedule	Section 8.1. Appendix A (Inspection sheets)
40 CFR 270.14(b)(6) UAC R315-3.2.5(b)(6)	Preparedness and Prevention	Section 3.0
40 CFR 270.14(b)(11)(i-ii, v) UAC R315-3.2.5(b)(11) (i-ii, v)	Facility Location Information Applicable seismic standard	Attachment 1; Section 4.0.
40 CFR 270.14(b)(11) (iii-v) UAC R315-3.2.5(b)(11) (iii-v)	Facility Location Information 100-year floodplain	Section 5.0
0 CFR 270.14(b)(14) UAC R315-3.2.5(b)(14)	Closure Certification and Notification	Appendix B
40 CFR 270.14(b)(16) UAC R315-3.2.5(b)(16)	Post-Closure Cost Estimate	Federal Facilities are exempt from this requirement
40 CFR 270.14(b)(18) UAC R315-3.2.5(b)(18)	Proof of Financial Coverage	Federal Facilities are exempt from this requirement
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (i)	Topographic Map Map Scale and Date	Figure 2-4; 1 inch = 20 feet 2.5; 1 inch=1000’
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (ii)	Topographic Map 100-year floodplain area	HWMU 2 is not located within a verified 100-year floodplain area (Figure 2-5).
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (iii)	Topographic Map Surface waters including intermittent streams	There are no surface waters or intermittent streams within the HWMU 2 area (Figure 2-4).
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (iv)	Topographic Map Surrounding land uses	HWMU 2 is within a military base. There are no nearby operations in the vicinity of HWMU 2. See Figure 2-4 & 2-5
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (v)	Topographic Map A wind rose (i.e., prevailing wind speed and direction)	The unit is closed with an engineered soil cover. There are no residential populations in the vicinity of HWMU 2. The closest residential area is English Village (approximately 30 miles away). A wind rose is not deemed necessary for HWMU 2.
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (vi)	Topographic Map Orientation of Map, North Arrow	Figure 2-4 & 2-5
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (vii)	Topographic Map Legal boundaries of the hazardous waste management facility.	The fenced area is shown in Figure 2-4.
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (viii)	Topographic Map Access control, fence, gates	The fenced area and access gates are shown in Figure 2-4.
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (ix)	Topographic Map Injection and withdrawal wells	There are no injection or withdrawal wells in the vicinity of HWMU 2. The monitoring wells are shown in Figure 2-4.
40 CFR 270.14(b)(19) UAC R315-3.2.5(b)(19) (xi)	Topographic Map Barriers for drainage or flood control	The HWMU site is graded to drain away from the soil cover. Also, a drainage ditch was constructed on the southwest side of the site. See Figure 2-4
40 CFR 270.14(c) UAC R315-3.2.5(c)(1)	Groundwater Monitoring Information	Section 2.4; HWMU 2 Closure Report Initial Groundwater Sampling 1995. Detection

Table 1-1: Summary of HWMU 2 Post-Closure Information Requirements Under 40 CFR 270.14 and UAC R315-3-2.19 and R315-3.2.5

Regulation Citation	Requirement Description	Location Requirement is Addressed
	Summary of Groundwater Data	Program (four quarters) 1999-2000 (UAC R315-13). Assessment Program (4 semi-annual events) 2001-2002 (UAC R315-13)
40 CFR 270.14(c) UAC R315-3.2.5(c)(2)	Groundwater Monitoring Information Identification of uppermost aquifer	Section 2.6. HWMU 2 Closure Report
40 CFR 270.14(c) UAC R315-3.2.5(c)(3)	Groundwater Monitoring Information Delineation of the Waste Management Area	Figure 2-5 (fenced area shown), HWMU 2 Closure Report includes the Legal Description for HWMU 2
40 CFR 270.14(c) UAC R315-3.2.5(c)(4)	Groundwater Monitoring Information Extent of Plume	Section 2.4 includes a description of the groundwater data. There is no identified plume at HWMU 2.
40 CFR 270.14(c) UAC R315-3.2.5(c)(5)	Groundwater Monitoring Information Detailed Plans/Engineering Report for Proposed Groundwater Program	Sections 2.0, 6.0 and 7.0 Groundwater Monitoring Work Plan & Sampling and Analysis Plan, Rev. 2 (IT, 2002) – submitted separately.
40 CFR 270.14(c) UAC R315-3.2.5(c)(6)(i)	Groundwater Monitoring Information No Hazardous constituents are present in the groundwater at HWMU 2. Proposed List of Parameters	Sections 2.0, 6.0 and 7.0, HMWU 2 Closure Report
40 CFR 270.14(c) UAC R315-3.2.5(c)(6)(ii)	Groundwater Monitoring Information No Hazardous constituents are present in the groundwater at HWMU 2. Proposed Groundwater Monitoring System	Sections 6.0 and 7.0
40 CFR 270.14(c) UAC R315-3.2.5(c)(6)(iii)	Groundwater Monitoring Information No Hazardous constituents are present in the groundwater at HWMU 2 Background Values	Table 7-2 Groundwater Monitoring Work Plan & Sampling and Analysis Plan, Rev. 2 (IT, 2002) – submitted separately.
40 CFR 270.14(c) UAC R315-3.2.5(c)(6)(iv)	Groundwater Monitoring Information No Hazardous constituents are present in the groundwater at HWMU 2. A description of the Proposed Sampling	Sections 2.0, 6.0 and 7.0. Groundwater Monitoring Work Plan & Sampling and Analysis Plan, Rev. 2 (IT, 2002) – submitted separately.

2.0. HWMU 2 DESCRIPTION

The following provides a general description of Hazardous Waste Management Unit (HWMU) 2, also known as the Waste Pile at the North End of Granite Peak at Dugway Proving Ground (Dugway) (Figure 2-1). The facility information requirements specified in UAC 315-3-2.5(d) for Solid Waste Management Units is addressed under the Dugway Proving Ground Storage Permit. Groundwater monitoring data and program information requirements for HWMU 2 as specified in UAC 315-3-2.5(d) is presented in the HWMU 2 Post-Closure Plan. A general description of the Dugway installation can be found in Module VII, Attachment 1.

2.1 Location and History

HWMU 2, known as the Waste Pile at the North End of Granite Peak, is a closed HWMU located north of Granite Peak and approximately 1,000 feet (ft) north of Stark Road (Figure 2-5). Figure 2-2 shows the location of HWMU 2 with respect to Granite Peak. This HWMU is located on a relatively flat valley floor at an approximate elevation of 4,290 ft mean sea level (msl). The nearest operating Dugway facility is the Baker Area, located approximately 12 miles east of Granite Peak. The central portion of Dugway, in which HWMU 2 is located, is now primarily used for test ranges. In the past, munitions disposal, decontamination, and other demilitarization activities were also conducted in this portion of Dugway.

HWMU 2 was used for disposal of a variety of solid wastes generated during range cleanup and the demilitarization activities. The unit consisted of two unlined trenches that were positioned end to end and trend northwest-southeast (See Figure 2-3). These trenches were approximately 50 ft apart. Ridges of excavated soil that were 4 to 6 ft high were located adjacent to each trench on the east side. The northern trench was about 145 ft long, 8 ft wide, and 3 ft deep, and the southern trench was approximately 110 ft long, 16 ft wide, and 2 to 4 ft deep. The central portion of the southern trench was backfilled with material from an adjacent pile of native soil to create a roadway across the trench for environmental sampling. A small drainage feature entered the southern end of the southern trench and another drainage feature exits the northern trench at the northern end. The northern half of the northern trench was vegetated with shrubs. Other features observed at HWMU 2 included a small area of burned material adjacent to the northern trench, which has since been excavated during closure activities.

2.2 Past Operation

HWMU 2 was used for disposal of a variety of solid wastes generated during range cleanup and the demilitarization activities. The unit may have also received biological agent laboratory wastes from Granite Peak Installation No. 2 (GPI-2), a former testing laboratory located 0.5 miles southeast of HWMU 2. According to a former Dugway employee, HWMU 2 had been in use since 1960. However, historical aerial photographs

indicate the trenches were present in 1953. Disposal activities at HWMU 2 ceased prior to 1993 when a removal action was conducted at this unit.

During an October 1991 site visit, each trench was observed to be filled with debris from a maximum depth of 5 ft to within 2 to 3 ft of the ground surface. Backfill and eroded soil partially covered the debris. The wastes observed in the trenches at that time included miscellaneous trash, scrap metal, construction debris, asbestos cylinders, laboratory waste, empty decontamination solution containers, landing mats, ordnance-related debris, and potential 3X materials. Among these items was a 500- to 700-pound (lb) German bomb that previously contained Tabun (GA). The bomb had been bored and the agent drained from the bomb before it was placed in the northern trench. An expanded burster tube for chemical weapons was identified in the small excavation east of the southern trench. Spent o-chlorobenzalmalononitrile (CS) canisters, glass fragments, and light bulbs were identified on the surface near the two trenches.

In 1993, surface debris was removed from the trenches during a removal action. Approximately 4.9 tons of salvageable scrap was taken to the Defense Reutilization Management Office (DRMO) and the remaining 31 tons of surface debris were taken to the Dugway Landfill on Stark Road for disposal.

HWMU 2 was one of the 27 sites listed at Dugway under the UDEQ-DSHW Stipulation and Consent Order No. 8909884 (dated September 19, 1990). This Consent Order directed Dugway to determine whether hazardous waste management occurred at these sites. This Stipulation and Consent Order was amended in December 22, 1993 and identified HWMU 2 among the sites to be closed.

2.3. Previous Investigations Documentation

Previous investigations at HWMU 2 have included geophysical, test pit, and soil investigations. The following subsections provide a brief summary of each investigation. Further details are included in the HWMU 2 Closure Report and in the Foster Wheeler Closure Plan (FWEC, 1998).

2.4. Detection And Assessment Monitoring Summary

Detection monitoring was conducted in Fiscal Year (FY) 2000 at HWMU 2. Assessment monitoring was conducted in FY 2001 and FY 2002. Appendix D, Table 5 of the HWMU 2 *Draft Final Closure Report* (IT, 2003b) presents a summary of all groundwater data from HWMU 2-to-date.

Detection monitoring wells MW01, MW02, MW03, and MW04 were sampled and analyzed for a number of constituents, including SVOCs, VOCs, polychlorinated biphenyls (PCBs), ABPs, dioxins, furans, explosives, gross alpha/beta, total metals, total organic carbon (TOC), total organic halide (TOX), herbicides, pesticides, PCBs, TDS, total suspended solids (TSS), radium, nitrate, sulfate, chloride, phenolics, fluoride, and total and fecal coliform bacteria.

2.4.1 Inorganics

As part of the Dugway Groundwater Monitoring Program, a number of inorganic constituents were detected above maximum contaminant levels (MCLs) or site background values (SBVs) in samples collected at HWMU 2 since FY 2000 monitoring activities. These constituents have included arsenic, barium, calcium, cobalt, magnesium, mercury, potassium, silver, sodium, strontium, thallium, titanium, chloride, fluoride, sulfate, gross alpha and beta, TDS, and TSS.

During the last monitoring event (October 2002) only arsenic and thallium, exceeded the Utah MCLs in wells MW02, MW03, and MW04. The last six events indicate that arsenic is above both the SBV and recently promulgated MCL of 10 micrograms per liter (μg/L) in the three downgradient wells (MW02, MW03, and MW04). The recently promulgated MCL of 10 μg/L will not be effective until January 23, 2006 for municipal water sources. It is presented for comparison. The current, effective MCL is 50 μg/L. During the most recent groundwater event (October 2002), all well concentrations were below the current MCL of 50 μg/L. The concentrations of the upgradient well (MW01) have been consistently below the MCL or SBV, thus suggesting the arsenic in groundwater may be site related. However, it should be noted that the highest arsenic concentrations in soil (SB12) have been excavated and removed as part of the closure activities. The remaining elevated concentrations have been covered by the engineered soil cover, thus greatly reducing any further infiltration to groundwater.

The thallium results have fluctuated over time. For example, during the March 2001 and August 2001 events, thallium was not detected in any of the wells. During the March 2002 event, the concentrations ranged from 5.4 μg/L to 6.7 μg/L from the four wells. During the most recent event (October 2002), thallium was detected in only the background well at 2.4 μg/L. Based on the data trends (see PES, 2002b; Figure D-1 of Appendix D), it does not appear that thallium is site related.

Sulfates were detected above the MCL and SBV in all four wells. Chromium was detected in well MW03 at 43 μg/L, which is above the SBV of 18 μg/L, but below the MCL of 100 μg/L.

Gross alpha concentrations were detected above its Utah MCL and SBV in FY 2000, FY 2001, and FY 2002; gross beta concentrations were detected above its Utah MCL and SBV in FY 2000 and FY 2001.

2.4.2 Organics

During the four quarters of detection monitoring in FY 2000 low-level detections of dioxins and furans near the practical quantitation limit (PQL) and low-level detections of organochlorine pesticides between the MDL and PQL were reported. However, in the

two assessment monitoring events in FY 2001 and two FY 2002 events, there have been no dioxins/furans detections. It should be noted that the highest levels of dioxins/furans in the soil, which were located in the burn area, have been excavated and removed. The remaining dioxins/furans are beneath the engineered soil cover, which is designed to minimize infiltration to the groundwater.

Organics were not detected in any of the groundwater samples collected during the most recent sampling event (October 2002) at HWMU 2 as part of the Dugway Groundwater Monitoring Program. However, there were low-level detections of phenolics in well MW04 during the first 2002 monitoring event and estimated detections between the PQL and MDL in wells MW01, MW03, and MW04 during the second 2002 monitoring event. Phenolics were also detected during the FY 2000 and FY 2001 groundwater monitoring program.

The detailed results of previous material, soil, and groundwater sampling, and closure information including the risk assessment are available, for HWMU 2 in the UDSHW public documents listed in Table 2-1.

Table 2-1: Pertinent UDSHW Library Documents Detailing HWMU 124 Investigations

Document Title	Received Date	UDSHW Library No.
IT, 2001a. *Final 100% Design Report for HWMU 2 Waste Pile at the North End of Granite Peak, Dugway Proving Ground, Dugway, U*	6/1/2001	DPG 00222
IT, 2002. *Final Groundwater Monitoring Work Plan and Sampling and Analysis Plan for the Consent Order Groundwater Monitoring Program, Dugway Proving Ground, Dugway, Utah, Revision 2.*	4/19/02	DPG 00274
IT, 2003 *Final Closure Report Hazardous Waste Management Unit (HWMU) 2; Waste Pile at North end of Granite Peak.*	2/28/2003	DPG 00318

2.5. Closure Activities

In 1993, surface debris was removed from the trenches during a removal action. Approximately 4.9 tons of salvageable scrap was taken to the Defense Reutilization Management Office (DRMO) and the remaining 31 tons of surface debris were taken to the Dugway landfill on Stark Road for disposal.

The closure of HWMU 2 has been completed. Approval for the HWMU 2 Closure Report (IT, 2003) was received in a letter dated from March 20, 2003, from Mr. Dennis R. Downs, Utah Solid and Hazardous Waste Control Board. Appendix B includes a copy of the HWMU 2 Closure Certification signed and stamped by a Utah-licensed Professional Engineer. In compliance with UAC R315-7-21, the HWMU 2 closure

provided a cover that will: 1) protect human health and the quality of the environment under conditions of continuing military use; 2) control, minimize, or eliminate the escape of hazardous constituents to soil, surface, groundwater, or the atmosphere during its closure and post-closure period; and 3) minimize the need for further maintenance. The final cover system (a 2-ft thick engineered, evapotranspiration soil cover) was designed and constructed to satisfy the requirements of these regulations namely:

1. Provide long-term minimization of migration of liquids through the closed landfill;
2. Function with minimum maintenance;
3. Promote drainage and minimize erosion or abrasion of the cover;
4. Accommodate settling and subsidence so that the cover's integrity is maintained; and
5. Have a permeability less than or equal to the permeability of any bottom liner or natural subsoils present.
6. Major closure activities at HWMU 2 included:
7. Excavation and disposal of burn area soil to remove elevated arsenic and dioxins/furans concentrations and discolored burnt soil followed by confirmation sampling and backfilling;
8. Installation of an engineered evapotranspiration soil cover;
9. Installation of a chain-link fence around the engineered soil cover; and
10. Upgrade of the existing access road, grading, and erosion control activities to minimize long-term maintenance requirements.
11. The final closure cover system consisted of the following components (from bottom to top):
12. A minimum 1-foot thick layer of self-compacting fill;
13. A compacted subgrade layer comprised of clean soil imported from the Dugway landfill;
14. An 18-inch thick layer of controlled permeability (permeability range of 1×10^{-4} cm/sec to 1×10^{-6} cm/sec); and
15. A 6-inch thick layer of vegetated soil cover.

All construction activities were completed in accordance with applicable UAC regulations, the Remedial Action Plan, the 100% Design Report, and approved Field Work Variances (FWVs). Figure 2-4 shows the post-closure configuration of the HWMU 2 engineered soil cover and existing site conditions.

All the permeability tests conducted on the 18-inch thick controlled permeability layer passed the established criterion of 1×10^{-4} cm/sec to 1×10^{-6} cm/sec. After completion of the 18-inch thick low permeability layer, the 6-inch thick vegetated soil layer was installed in a single lift using the same source of import material from the Dugway Landfill. This final lift (vegetated layer) was then drill-seeded. The selected vegetation is in compliance with the Forage and Conservation Planting Guide for Utah (EC433) developed by the Cooperative Extension Service of Utah State University (Utah State University, 1989) and appropriate for arid environments.

Other construction activities included construction of a swale and other miscellaneous grading around the landfill, installation of a chain-link fence and appropriate signage around the engineered soil cover, upgrading the existing road for access during the rainy season, and re-seeding the disturbed areas outside the engineered soil cover. As part of general grading efforts, drainage along the east side of the former dirt road was redirected to the west side of the road by construction of a swale. The swale has a maximum depth of six inches. General grading was also completed to fill low-lying areas around the southern and eastern sides of the soil cover to prevent precipitation from running onto the soil cover. The road improvements consisted of upgrading the existing dirt road. The cross section of the roadway as designed and constructed is approximately 12 ft wide and 8 inches thick with a 2 percent crown along the centerline of the roadway. Final lines and grades were surveyed for as-built documentation purposes.

2.5.1. Post Closure Regulatory Basis

Utah has specific regulations governing the closure and post-closure requirements for interim status hazardous waste treatment, storage and disposal facilities (TSDFs) (UAC R315-7-14). Post-Closure groundwater monitoring requirements must comply with requirements specified in UAC R315-7-21 and R315-7-13. These regulations are derived from 40 CFR 265 subparts F (Groundwater Monitoring) and subpart G (Closure and Post-closure Care). In accordance with UAC R315-7-21.4b, the following are the requirements for post-closure care:

1. After final closure, the owner or operator shall comply with all post-closure requirements contained in R315-7-14, which incorporates by reference 40 CFR 265.110 - 265.120, including maintenance and monitoring throughout the post-closure care period. The owner or operator shall:
2. Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;
3. Maintain and monitor the leak detection system in accordance with R315-8-14.2(c)(3)(iv) and (4) and R315-7-21.12(b), and comply with all other applicable leak detection system requirements of R315-7 The HWMU 2 engineered soil cover is exempt from this requirement because it qualifies as an “existing unit” exempt from the minimum requirements imposed by Hazardous and Solid Waste Agency (HSWA) for new landfills.
4. Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of R315-7-13;
5. Prevent run-on and run-off from eroding or otherwise damaging the final cover; and
6. Protect and maintain surveyed benchmarks used in complying with R315-7-21.3.”

Based on the work performed at HWMU 2 and the risk evaluations presented in the Final Closure Report, the requirements specified under 40 CFR 265, subpart G and a Consent Order have been achieved.

The detailed results of previous material, soil, and groundwater sampling at HWMU 2 are included in the. *Draft Final Closure Report for HWMU 2 Waste Pile at the North End of Granite Peak (Closure Report), Dugway Proving Ground, Dugway, Utah*. *(IT, 2003b)*.

The closure of HWMU 2 has been completed. Approval for the HWMU 2 Final Remedial Action Closure Report (IT, 2003) was received in a letter dated March 20, 2003, from Mr. Dennis R. Downs, Utah Solid and Hazardous Waste Control Board. Appendix B includes a copy of the HWMU 2 Closure Certification signed and stamped by a Utah-licensed Professional Engineer. UDSHW verified the Closure of HWMU 2 on August 4, 2003. With the investigative, remedial, and closure actions performed at this site, all stipulations of the Consent Order has been satisfied for HWMU 2.

2.6. Groundwater

Four shallow groundwater monitoring wells (MW01, MW02, MW03, and MW04) were installed at HWMU 2 during Mobilization 3 in 1995 (Figure 2-3). Monitoring well MW01 was installed up-gradient of the trenches, and wells MW02, MW03, and MW04 were installed down gradient, north and northwest, of the trenches. All four monitoring wells are screened from approximately 7 to 23 ft bgs. The subsurface consists primarily of clayey silts with interbedded fine sands that appear to be laterally discontinuous. The four sand layers (A to D) present below 23 ft may be referred to as the shallow aquifer. The shallow aquifer has a maximum depth of approximately 95 ft bgs near HWMU 2. The water table occurs in fine-grained material above the first sand zone. The shallow groundwater found in HWMU 2 has TDS in excess of 10,000 mg/L indicating that the water is saline. Based on UAC R317-6-3, the water is Class IV and is nonpotable.

Water-level measurements from detection and assessment monitoring indicate the groundwater in the shallow aquifer beneath HWMU 2 flows northwest with a gradient of 0.002 ft/ft. The groundwater elevation is approximately 4,272 ft above mean sea level (msl) (12 to 13 ft bgs), approximately 5 to 7 feet below the trench bottoms. Well MW01 is the upgradient well, wells MW02 and MW03 are downgradient, and MW04 is crossgradient. The present groundwater monitoring well placement provides an adequate monitoring system for HWMU 2 (IT, 2003a).

Slug tests were performed in each of the four monitoring wells to provide estimates of hydraulic conductivity of the shallow aquifer. With the use of the results of the rising-head slug tests, the hydraulic conductivity of the shallow unconfined aquifer was estimated to be between 4 and 22 ft per day (ft/day), averaging 13 ft/day. The average linear flow velocity of approximately 38 ft per year was calculated using a hydraulic gradient of 0.002 ft/ft, the average hydraulic conductivity of 13 ft/day, and assumed

effective porosity of 25 percent for lean clays with fine sands. Higher values of effective porosity would result in lower groundwater velocities and longer travel times. Slug tests and laboratory tests were also performed to measure horizontal and vertical components of hydraulic conductivity, respectively. These tests indicated that the vertical hydraulic conductivity is much lower than the horizontal conductivity. (FWEC, 1996)

Water Supply Well 10, located upgradient approximately 3,000 ft southeast of the site, is the only water supply well in the vicinity of HWMU 2 (Figure 2-2). In 1944, it was drilled to a depth of 155 ft bgs and was screened between 135 and 155 ft bgs. The log for the well indicates the presence of sand and boulders to 142 ft and granite bedrock from 142 to 155 ft bgs. Groundwater was encountered between 85 ft and 125 ft during drilling. A static water level of 21 ft indicates that the deeper groundwater flow regime in this area is under confined conditions and separated from the shallow saline aquifer. The deeper aquifer is periodically used as a source of nonpotable water. In March 28, 1950, laboratory analyses indicated that water from Well 10 contained 1,670 milligram per liter (mg/L) of total dissolved solids (TDS) (FWEC, 1998). Under UAC R317-6-3, the water is classified as Class II, and potable.

2.7. Closure Notifications

Federal facilities are exempt from submitting notifications to the local zoning authority as required by 40 CFR 264.116 and 264.119, which are incorporated by reference in R315-8-7. Dugway's Post-Closure Land Use Tracking Plan (LUTP) shall be used to monitor land use as required under this Permit in Module VII, Condition F.4.

3.0. SECURITY AND CONTINGENCY REQUIREMENTS

The Permittee shall comply with the following security conditions as applicable to HWMU 2:

1. HWMU 2 is located within a federal, military installation (Dugway Proving Ground). As such, the installation is restricted for the common population. Access to HWMU 2 is strictly monitored by Dugway Base Security (Range Control).
2. Specifically at HWMU 2, a fence with two locked gates surrounding the closed unit on all sides, which prevents unauthorized entry, shall be maintained throughout the post-closure care period.
3. Signs, which read "DANGER, UNAUTHORIZED PERSONNEL KEEP OUT", are posted at the entrance gates and every 50 feet along the fence and shall be maintained throughout the post-closure care period. The signs must be legible from a distance of at least 25 feet in compliance with R3l5-8-2.5(c).
4. All security equipment shall be inspected throughout the post-closure care period. The Permittee shall incorporate those security items (i.e., fence, signs of vandalism, etc.) to be inspected and the frequency of inspection on the inspection schedule.

5. Damaged security equipment shall be noted in the inspection checklist. Repairs shall be completed as soon as practicable after the problem is discovered, in compliance with R3l5-8-2.6(c).

3.1. Contingency Plan

This section provides information about emergency response inspection procedures to be implemented in the event of any natural disaster in the Dugway Proving Ground area that may affect the soil cover at HWMU 2. Appendix A provides an emergency response inspection checklist.

The Dugway Emergency Response and Contingency Plan (Part B Permit), where applicable to this site, shall be used to announce and respond to emergency conditions. At a minimum, the site inspector should have a radio or phone and a First Aid kit available during inspections.

3.1.1. Earthquakes

Dugway Proving Ground is located in Seismic Zone 2 with a maximum acceleration of 0.16 gravity force (IT, 2001a). In the event of a 6.5-magnitude or higher earthquake centered within 50 miles of the site, qualified personnel will visually inspect the landfill cap for signs of damage as soon as it is safe and practical to do so. Any damage to the landfill cap will be repaired to ensure the integrity of the cap. If the landfill cap has sustained extensive damage, Dugway will implement corrective actions to ensure that contaminants are contained and human health is protected. Post-earthquake site inspection records will be submitted to the Dugway Environmental Department.

Following an earthquake, the landfill and landfill cap will also be inspected for lateral shifting of debris. Settlement markers will be resurveyed to determine any horizontal or vertical movement of the cap.

3.1.2. Floods or Major Storms

In the event of a flood or major storm, Dugway will inspect the landfill cap to ensure its integrity within 72 hours of the event. A checklist is included in Appendix A. A major storm is defined in this plan as a storm with 1 inch of precipitation or more over a 24-hour period. Any damage to the landfill cap will be repaired as soon as possible to ensure the integrity of the cap.

3.1.3. Fire

The event of a fire is an unlikely event at HWMU 2 given its remote location with respect to other base facilities. Nonetheless, in the event of a surface fire near the landfill cap, the Dugway fire department will be notified and the Dugway integrated contingency plan will be implemented. In the event of a landfill fire, if the cap is observed to have been

breached, other firefighting methods (such as using foam or smothering with dirt) will be considered and used, as appropriate. Following the incident, Dugway will perform a thorough inspection of the landfill cap using the emergency response checklist included in Appendix A, to ensure that the integrity of the soil cover has not been compromised and waste is not exposed. If there is fire damage, DPG will implement corrective actions to ensure that contaminants are contained and human health is protected.

4.0. SEISMIC STANDARD

HWMU 2 is not located within 200 feet of faults, which have displacement in Holocene time. Although, Utah is tectonically active, most of the earthquake activity occurs about 55 miles to the east along the Wasatch Range Foothills. The U.S. Geological Survey has conducted a study ([U.S. Geological Survey (USGS), 1988]. Map of Fault Scarps Formed on Unconsolidated Sediments, Tooele 1°x2° Quadrangle, Northwestern Utah. Compiled by T.P. Bamhard and R. L. Dodge) to determine the distribution, relative age, and amount and extent of surface rupture on Quaternary fault scarps in the Tooele 1x2 Quadrangle in northwestern Utah. The conclusions of the study state that morphologic and geologic data collected along the fault scarps in the area indicate that all were formed during the later Pleistocene era with no clear evidence of Holocene surface faulting. Several faults inferred on geophysical evidence are located on Dugway; however, there is no evidence of displacement during Holocene time.

5.0. FLOODPLAIN STANDARD

HWMU 2 is not located within a 100-year verified floodplain. A National Flood Insurance Rate Map, identifying the boundary of the 100-year flood, has not been prepared for Dugway. These are no permanent streams or other surface water bodies on Dugway. Surface water from precipitation flows through well-established drainage channels into the flat plain and evaporates. Like other arid regions, Dugway is subject to flash flooding following high-precipitation events. Flash floods have occurred only four times in the history of the installation, in 1944, 1952, 1973, and 1983. The major area affected during flash floods has been the Government Creek drainage channel, which has overflowed and caused minor inundation of roads at Ditto Technical Center.

HWMU 2 is located at the north end of Granite Peak, approximately 20 miles from the Ditto Technical Center. Because of the location of HWMU 2, it is not likely that a 100-year flood would affect the site.

The area around HWMU 2 has been graded to divert surface water away from the engineered soils covers. In addition, a swale was constructed along the southern edge of the site to diver runoff coming from Stark road (Figure 2-4).

6.0. POST- CLOSURE GROUNDWATER SAMPLING

This section describes the recommended post-closure groundwater monitoring requirements for HWMU 2. It describes the wells to be sampled, the analyte list, data quality objectives, and recommended monitoring frequency.

As indicated previously in this plan, the purpose of post-closure groundwater monitoring is to demonstrate that the engineered soil cover is functioning as designed (i.e., minimizing infiltration of contaminants to the groundwater), and to detect any releases to the groundwater. The current site data does not show any significant contamination in the groundwater at HWMU 2.

6.1. Groundwater Sampling Design and Rationale

HWMU 2 was included in the Dugway Detection Groundwater Monitoring Program for fiscal year 2000. Under the detection monitoring program, monitoring wells MW01, MW03, and MW04 were sampled quarterly in FY 2000 and analyzed for semi-volatile organics (SVOCs), volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), agent breakdown products (ABPs), dioxins, furans, explosives, herbicides, pesticides, gross alpha and gross beta, total metals, total organic carbon (TOC), total organic halides (TOX), total dissolved solids (TDS), total suspended solids (TSS), radium, nitrate, and sulfate, chloride, phenolics, and total and fecal coliforms. No organics were detected above their corresponding Utah Maximum Contaminant Level (MCL) or Site Background Value (SBV). Thallium, gross alpha, radium, sulfate, and TDS exceed its corresponding MCL. Low levels of dioxin/furans near the practical quantitation limit (PQL) were detected in 2000; however, there were no detections of these compounds in the four subsequent FY2001 and FY2002 semi-annual sampling events.

The analytical list for the FY2002 groundwater sampling events at HWMU 2 included TOX, TOC, organochlorine pesticides, ABPs, dioxins/furans, total metals, phenolics, chloride, sulfate, nitrate, gross alpha and gross beta. Of the chemicals detected in FY2002, gross alpha, thallium, sulfate, and arsenic exceeded either the Utah MCL or corresponding SBV.

The saline non-potable groundwater at HWMU 2 has already been sufficiently analyzed for specific organics (VOCs, SVOCs, PCBs, ABPs, pesticides, herbicides, explosives, etc.), with only an anomalous detection of low-level dioxin/furans in FY2000.

Based on the previous monitoring results discussed, there is no significant groundwater contamination underlying HWMU 2. Only arsenic concentrations in groundwater have been shown to be potentially impacted by past site activities. Nonetheless, the existing concentrations are below the current MCL of 50 μg/L. Dioxin/furans were detected in 2000, but have not been detected since then (four sampling events 2001-2002). No other organics have been detected at HWMU 2. The closure measures (installation of an engineered soil cover) implemented at the site were designed to minimize impact to the

groundwater by minimizing infiltration through the waste. Ongoing groundwater monitoring during post-closure care is recommended to ensure that the engineered soil cover is functioning as designed. However, because past site operations have not impacted groundwater significantly, it is expected that the current site conditions (engineered soil cover installed) would greatly reduce impact to groundwater in the future assuming proper maintenance of the soil cover is performed. In addition, it should be noted that the shallow groundwater at HWMU 2 is classified as Class IV saline and non-potable. The nearest water well (MW10), which is screened in a deeper aquifer, is not used for potable uses.

Thus, the recommended frequency of post-closure groundwater monitoring for the four monitoring wells at HWMU 2 (MW01, MW02, MW03, and MW04) is to be on a biennial basis (every two years). This sampling frequency is considered to be adequate based on the groundwater data collected thus far, the closure measures implemented, and the groundwater classification at HWMU 2 (Class IV). Based on monitoring results, the frequency may be increased or decreased, as deemed necessary, with approval from the Executive Secretary.

Based on the historical data, the recommended parameter list for HWMU 2 will include metals (limited list), sulfate, gross alpha, and gross beta. The proposed list of analytes is sufficient and appropriate for long-term groundwater monitoring at HWMU 2. The limited list of metals includes those metals that have been historically detected above its corresponding SBV or Utah MCL, including arsenic and thallium.

In addition, water level measurements and water quality parameters will be taken during each sampling event.

6.1.1. Regional Groundwater Approach

Dugway is currently developing a regional groundwater management plan for Ditto, Carr, English Village, and Downrange areas (PES, 2002b). Currently, the Ditto areas are being evaluated with respect to groundwater conceptual models predicting plume migration, regional background values, and monitoring approaches. When the regional groundwater management plans are finalized for downrange areas, which include HWMU 2, applicable changes in the groundwater-monitoring program at HWMU 2 will be implemented.

6.2. Data Quality Objectives

For project planning, the data quality objective (DQO) process was applied to optimize the design of data gathering and analysis activities required to meet the objectives as defined in this Post-Closure Plan. The results of the application of the seven-step DQO process prescribed by the U.S. Environmental Protection Agency (USEPA, 1997) are summarized below.

6.2.1. State the Problem

Post-Closure groundwater monitoring requirements must comply with the regulations established in R315-7-13, which are designed to detect and assess hazardous waste contamination in environmental media. The groundwater monitoring regulations stipulated in R315-7-13 establishes two distinct groundwater-monitoring programs: the Detection Monitoring and Assessment Monitoring Programs. The Assessment Monitoring Program will be continued as the post-closure groundwater-monitoring program for HWMU 2.

6.2.2. Identify Decisions

The Assessment Monitoring Program stipulates specific field monitoring and sampling protocols to comply with the regulations and results that are used to make determinations for future monitoring requirements. The decisions typically sought include (but are not limited to):

1. Compare results of downgradient sampling and determine whether monitoring well analytical data exceeds Utah MCLs and site specific SBVs;
2. Determine the lateral and vertical extent of groundwater or plume flow direction or gradient.
3. Assess if lateral and/or vertical extent of groundwater contamination has increased or decreased;
4. Evaluate whether the existing engineered soil cover system is functioning as designed with respect to groundwater protection; and
5. Assess the need for adjustments (additions or deletions) to monitoring program; including target parameters, additional monitoring wells, or abandonment of existing monitoring wells.

6.2.3. Identify Inputs to the Decisions

The inputs to the decision include the state and federal regulations, site history, documentation of previous site activities and remedial actions, and historical groundwater results. Historical monitoring well data and site SBVs and Utah MCLs will be used to evaluate analyte concentration trends. Current and historical water level measurements will be used to describe current characteristics and changing conditions in the subsurface hydrogeology. Each year an Annual Post-Closure Groundwater Report will be prepared for all Dugway Post-Closure HWMUs summarizing the results of the preceding year with respect to monitoring and chemical analysis. Since HWMU 2 will be sampled biennially, reporting for HWMU 2 groundwater data will also be biennial. Should HWMU 2 be incorporated into a regional approach, both the sampling and reporting frequencies will follow the regional plan.

6.2.4. Study Boundaries

The limits of this program include the lateral and vertical extent of monitoring well coverage for HWMU 2. The temporal boundaries of the data are annually based on the requirements in UAC R315-7-13, and amended as needed in the final submittal of the Annual Post-Closure Groundwater Report for Dugway Post-Closure HWMUs. It should be noted that reporting for HWMU 2 groundwater data results will be reported biennially.

6.2.5. Develop Decision Rules

1. The data collected as part of the Post-Closure Groundwater Monitoring Program will be used to make the following decisions:
2. If pH has significantly increased or decreased, and/or if specific conductance, has significantly increased compared to SBVs, then notification will be made to Dugway who will then notify the Executive Secretary;
3. If target analytes exceed the MCLs and/or the SBVs, then notification will be made to Dugway who will then notify the Executive Secretary;
4. If changes in new trends or reversal of trends are noted based on the sampling results, then a notification will be made to Dugway who will then notify the Executive Secretary; and
5. If a change in groundwater or plume flow direction or gradient is observed, recommendations for additional well sampling or installation may be made.

6.2.6. Specify Tolerable Limits on Decision Errors

The collected groundwater data provides an estimate of the true conditions and contains unidentified random and systematic errors. Two types of errors may be incurred: Type I, basing the decision on positive data which is in fact false, a *false positive error,* and Type II, basing a decision on negative data which is in fact positive, a *false negative error*.

Newly-collected data will be compared to the trends defined by historical data, and results that appear to be outliers will be carefully evaluated for error. The evaluation will include verification of laboratory data through review and evaluation; review and verification of field documentation for error; and evaluation of field quality control sample results including results of the analysis of ambient blanks, equipment rinsates, and source blanks for systematic problems. In most cases, the required PQLs are established at levels below the regulatory limits that include SBVs and Utah MCLs, and the possibility of committing the more serious, false negative error is minimal. For some analytes, the SBV or Utah MCL is less than the PQL. All data will be reported to the laboratory MDL. Data reported between the MDL and PQL has a larger associated uncertainty and the risk of committing either type of error increases. In this case, comparison of the data with the body of historical data minimizes the possibility of both false positive and false negative type errors.

Sampling techniques and quality control (QC) protocols as prescribed in the WP&SAP (IT, 2002) will be adhered to and result in the collection of representative samples. Field duplicate sample collection will provide the basis for an estimation of sampling precision. The analysis of matrix spike samples will provide an estimation of the accuracy of test results in project-specific matrices. To limit decision errors associated with laboratory data, Utah-certified and DOD QSM compliant laboratories will be employed, standard methods will be used, and quality control requirements will be established for each test method. The analytical method requirements include quantitative limits on accuracy, precision, completeness and sensitivity.

If the regional approach is implemented at HWMU 2 and includes alternate sampling techniques, those techniques will be previously approved and followed.

6.2.7. Optimize the Design for Obtaining Data

In order to minimize the chance of cross contamination, the wells at each HWMU will be sampled from the lowest contamination to highest based on the analytes of concern and historical site usage at Dugway.

The analytical methods were selected to provide the highest quality data and meet the project sensitivity requirements wherever possible. For thallium by USEPA Method 6010B, the Utah MCL is below the method's PQL. In order to achieve the maximum sensitivity for all target analytes, the laboratory will be requested to report detected analytes to the MDL.

6.3. Sampling Requirments

Sampling requirements for the post-closure groundwater monitoring program, including well locations, analysis, and QC requirements have been established in the GWM WP&SAP (IT, 2002), and from recommendations in the Annual Post-Closure Groundwater Report. Groundwater sampling procedures will be performed in accordance with this plan.

6.3.1. Well Locations

Monitoring wells MW01, MW02, MW03, and MW04, previously sampled as part of the Assessment Monitoring Program, will be monitored and sampled for the analyses shown in Table 6-1. The analytes were selected based on the recommendations in the Fiscal Year 2002 Groundwater Monitoring Report (IT, 2003a).

6.3.2. Groundwater Sampling Frequency and Analysis

The selected parameters for chemical analysis have been determined based on the detection and assessment programs. However, for HWMU 2 parameters will be re-evaluated biennially in the Annual Post-Closure Groundwater Report.

Groundwater sampling will be conducted biennially based on the Assessment Monitoring Program for a period of 30 years, unless specified by an approval to a recommendation for reduction made in the Annual Post-Closure Groundwater Report. It should be noted that HWMU 2 will be monitored biennially and therefore reporting will be on a biennial basis. The analytical parameters chosen for analyses will be determined from the results of the previous year and will be presented in the Annual Post-Closure Groundwater Report. In addition to the chemical analyses, water levels, pH, temperature, conductivity, and turbidity will be measured in the field. Table 7-1 of this plan presents the Planned Sample Table for post-closure monitoring at HWMU 2.

Table 6-1: Post-Closure Groundwater Monitoring Program Analyte List, HWMU 2

Upgradient Well	DOWNGRADIENT WELLS	**Analyses**	**Frequency**
002-MW01	002-MW02 002-MW03 002-MW04	Total Metals* Sulfate Gross alpha Gross beta	Biennially
002-MW01	002-MW02 002-MW03 002-MW04	TOX	2006** 2012** 2016** 2022** 2026**

* Limited list. See Table 7-2.
** TOX analyses incorporated into program for the sampling event immediately prior to the 5-year review. See below for an example schedule.

2004	2005	2006	2007	2008 5-Year Review	2009	2010	2011	2012	2013 5-Year Review	2014	2015	2016	2017	2018 5-Year Review	2019	2020	2021	2022	2023 5-Year Review	2024	2025	2026	2027
		X						X				X						X				X	

Shaded squares identify normal bi-annual sampling events typically conducted in October.
Xs below the sampling events indicate events during which TOX analyses will be conducted.

7.0. GROUNDWATER SAMPLING ACTIVITES

7.1. Presampling Considerations

Presampling requirements and activities are described in Section 4.0 of the GWM WP&SAP (IT, 2002). This section includes descriptions of the sampling team organization, planning activities, mobilization activities, and health and safety requirements. A planned sample table (PST) will be prepared as part of the planning activities. The PST for the Year 1 event is presented in Table 7-1.

7.2. Field Activities

Field activities are described in Section 5.0 of the GWM WP&SAP (IT, 2002). The activities include documentation and chain-of-custody procedures, field equipment calibration and maintenance, water level measurement, well purging, groundwater sampling, sample preservation, field equipment decontamination, sample packaging and transportation, and waste handling. Operating Procedures (OPs) are included in the GWM WP&SAP (IT, 2002).

Table 7-1: Planned Sample Table, HWMU 002 Post-Closure Groundwater Monitoring Program

					Aqueous Preservative	H2SO4	ice, HNO3	ice	ice, HNO3	ice, HNO3	**Laboratory**	COMMENTS
					Aqueous Container	2X 250 mL A	1X.5L PE	1X1L PE	1X1L PE	1X1L PE		
					Aqueous Extraction Holding Time	---	NA	NA	NA	NA		
					Aqueous Analysis Holding Time	28 days	6 months	28 days	6 mos.	6 mos.		
					Method	SW9020B	SW6010B	SW9056	SW9310	SW9310		
Sample Location	Index Number	Matrix	Sample Method	Sample Type	Schedule	**TOX**	**Metals-Total ICP [1]**	**Sulfate**	**Gross Alpha**	**Gross Beta**		
002-MW01		WG	SP	NS	Day 1	2X*	2X	2X	2X	2X	TBD	Biennial - Monitoring, **MS/MSD[2]**
002-MW02		WG	SP	NS	Day 1	X*	X	X	X	X	TBD	Biennial - Monitoring
002-MW02		WG	SP	FD	Day 1	X*	X	X	X	X	TBD	Biennial - Monitoring
002-MW03		WG	SP	NS	Day 1	X*	X	X	X	X	TBD	Biennial - Monitoring
002-MW04		WG	SP	NS	Day 1	X*	X	X	X	X	TBD	Biennial - Monitoring
AB1		WQ	NA	AB	Day 1		X				TBD	Ambient Blank
EB1		WQ	NA	EB	Day 1		X				TBD	Equipment Rinse Blank
SB		WH	NA	SB	Day 1		X	X			TBD	Source Blank[3]
					Total Aqueous Containers	12	9	7	6	6		
					Total Analyses	5	8	6	5	5		

Sample containers:	**Matrix:**	**Sample Method Code:**	**Sample Type:**
A - Amber	WG - Groundwater	NA - Not Applicable	AB - Ambient Blank
PE - Polyethylene	WH - Source Water	PP - Portable Pump	NS - Normal Sample
	WQ - QC Water	SP - Submersible Pump (Dedicated)	EB - Equipment Rinse Blank
			FD - Field Duplicate
			SB - Source Blank

X* = TOX analyzed during single event immediately prior to the 5-year review.

[1] 11 Metals with Utah MCL, see Table 7-2.

[2]**MS/MSD = twice the normal volume will be collected for MS/MSD. One sample per 20 field samples or one sample per shipment to the laboratory, whichever is more frequent,** will be collected for MS/MSD. The samples designated MS/MSD in this table are provided as an estimate and MS/MSD samples may be collected at different or additional locations.

[3]Source Blank = A source water blank sample will be collected for each batch of source water for the project. It may or may not be collected for this specific HWMU depending on the course of field activities.

Ambient blanks will be collected each day ambient conditions warrant possible contamination (5% minimum)

Equipment rinse blanks will be collected at a minimum fo 5% of those samples collected using a portable pump (or other non disposable reuseable equipment to collect groundwater samples).

Table 7-2: Water Target Analytes, Practical Quantitation Limits, and Regulatory Levels
HWMU 002; Dugway Proving Ground, Dugway, Utah

Parameter	*Control Compound*	*PQL*	*Utah MCL*	*SBV*	*Units*
Anions by Ion Chromatography by EPA Method 9056					
Sulfate	X	1000	1000000	1370000	µg/L
Gross Alpha/Beta by EPA Method 9310					
Gross Alpha	X	4	15000	168	pCi/L
Gross Beta	X	4	50000	22	pCi/L
Mercury by CVAA by EPA Method 7470A					
Mercury		0.2	2	0.2	µg/L
Metals by ICP by EPA Method 6010B/6020					
Antimony		6	6	6	µg/L
Arsenic	X	10	10	15	µg/L
Barium		5	2000	55	µg/L
Beryllium		4	4	4	µg/L
Cadmium	X	5	5	5	µg/L
Chromium	X	10	100	18	µg/L
Copper		10	1300	17	µg/L
Lead	X	10	15	10	µg/L
Selenium		10	50	25	µg/L
Thallium		5	2	4	µg/L
Total Organic Halides by EPA Method 9020B					
Total Organic Halides	X	50	---	1600	µg/L

--- = not available
MCL = Maximum Contaminant Level
pCi/L = pico Curies per Liter
PQL = Practical Quantitation Limit
SBV = Site Background Value
µg/L = micrograms per Liter

Circled PQLs are greater than the Utah MCL. Thallium will be reported to the laboratory method detection limit.

7.3. Laboratory Analysis

Laboratory analytical methods and requirements are described in Section 6.0 of the GWM WP&SAP (IT, 2002). The laboratory performing the analyses described herein will be Utah-Certified and DOD QSM compliant. The GWM WP&SAP includes a description of the analytical methods, the analytical quality control requirements, precision and accuracy, laboratory corrective actions, analytical results reporting, quality control summary reports, completeness summary, and assessment and oversight guidelines. Table 7-2 lists the analytical methods and their associated Utah MCLs and PQLs.

7.4. Data Management Plan

The data management plan is described in Section 7.0 of the GWM WP&SAP (IT, 2002). The elements of the plan include the objectives, background, responsibilities, data types, software, database structure, data processing procedures, and required documentation.

7.5. Investigation-Derived Waste

Procedures for handing of investigation-derived waste (IDW) are documented in Section 8.0 of the GWM WP&SAP (IT, 2002). The objectives, background, and responsibilities

for handling of IDW are discussed along with details on the required materials and procedures for waste minimization, waste containerization, waste characterization, management of specific types of IDW, drum management, and record-keeping.

8.0. POST-CLOSURE OPERATIONS, MAINTENANCE AND REPORTING

The HWMU 2 waste pile has been covered with an engineered soil cover. The following sections discuss the Operation and Maintenance (O&M) procedures and the Reports required to ensure maintenance and monitoring of the engineered soil cover during the post-closure period.

8.1. Site Inspections

General site inspections of the landfill area will be conducted semi-annually by May 1st and November 1st to ensure that the integrity of the landfill cap is maintained. The following post-closure inspections will be required.

1. General site inspections;
2. Vegetative cover inspections;
3. Soil Erosion Control inspections.

8.1.1. General Inspection

The site shall be visually inspected to ensure the following conditions are maintained at the site:

1. Proper warning signs are present;
2. The perimeter fence is in good condition and secured;
3. No weeds (with deep taproots) are present that may penetrate the cap;
4. No excessive soil erosion is evident on the cap surface or at the cap edges;
5. No noticeable damage to the soil covering from burrowing animals;
6. No excessive vegetation is growing in the swale drainage ditch;
7. No noticeable depressions or ponded water are present;
8. No noticeable sliding (slope failure) or desiccation cracks are present in the soil cover; and
9. No excessive erosion of the all-weather road accessing and surrounding the HWMU 2 soil cover is evident.

As part of the routine inspection, settlement marker locations and elevations should be surveyed at least once every six months for the first year after construction, and annually thereafter. When a settlement of 0.1 foot or less has been measured for two consecutive years, surveys can be scaled back to once every five years. The baseline northings, eastings (State Plan, Nad 83 Central Zone), and elevations of the settlement markers are summarized in the table below.

Table 8-1: Surveyed Coordinates for HWMU 2 Settlement Markers.

Type	Location	Northing (ft)	Easting (ft)	Elevation (ft above msl)
Settlement Marker (SM-1)	South end of soil cover	7237846.49	1136002.64	4283.56
Settlement Marker (SM-2)	North end of soil cover	7238035.42	1135922.90	4284.73

8.1.2. Vegetative Cover Inspection

The vegetative cover will be inspected at the time of the regularly scheduled general inspection to ensure proper vegetation growth that prevents soil erosion. As with the general inspections, upon approval from the Executive Secretary, the vegetative cover inspections can be reduced to once per year, once vegetation has established a healthy growth cycle. A vegetative cover inspection checklist is provided in Appendix A and should be completed.

The types of grasses seeded on the engineered soil cover included crested wheatgrass, Sandberg Bluegrass, and Bottlebrush Squirrel Tail. These are bunchgrass species that are native to Dugway and drought-resistant which is ideal for arid environments. These are also effective for soil erosion and evapotranspiration. Bunchgrasses grow in bunches or tufts and are not "full cover." Therefore, it is expected that bare patches on the vegetative cover will be visible.

The vegetative cover should be inspected for:

1. Areas of stressed or missing vegetation on the cover (bald spots);
2. Areas of continual poor growth despite reseeding efforts;
3. Invasive (cheat grass) or deep-rooting species; and
4. Impacts from burrowing animals.

Inspections will be made to ensure that the vegetative layer is functioning as designed (i.e., erosion protection). If erosion is evident, affected areas will be repaired, and the area be reseeded using the original seed mix used during closure activities (IT, 2003b) at the direction of the Dugway Environmental Office.

8.1.3. Soil Erosion Control Inspection

The surface water control system should be inspected to ensure that it is providing adequate erosion control. The checklist in Appendix A includes procedures for ensuring that soil erosion is controlled.

If signs of soil erosion are excessive (for example, cracks or rills greater than two inches wide) and continual (recurring in the same area), corrective action may be needed. Significant cracks and/or rills that have the potential to impact the functionality of the cover system will be documented in the inspection forms. Corrective actions may

include filling in the eroded or cracked area, investigating the cause of erosion, and regrading slopes.

8.1.4. Corrective Action

For most routine repairs, corrective action should be initiated as soon as practical after identifying the problem, or as directed by Dugway. If the corrective is extensive, or will require more that 30-days to complete, then Dugway shall provide a corrective action schedule for approval by the Executive Secretary. Table 8-2 presents the Post-Closure Inspection Schedule for HWMU 2, and lists the items to be inspected and potential problems. Most inspections will be performed semi-annually. Inspection personnel will note any problems found and will inform appropriate DPG representatives.

Table 8-2: HWMU 2 Post-Closure Inspection and Monitoring Schedule.

Inspection/Monitoring Item	Method of Documentation (Appendix A)	Frequency of Inspection
Soil Cover Inspection cover integrity erosion settlement subsidence surface water drainage systems	General Site Inspection Checklist	Semi-Annual Spring Inspection due by May 1st; And the fall inspection due by November 1st. An additional inspection shall be required after a heavy rain event.
Vegetative Cover	Vegetative Cover Inspection Checklist	Semi-Annual
Settlement Marker Survey	General Site Inspection Checklist	Surveys once every six months for the first year after construction; And annually thereafter. When a settlement of 0.1 foot or less has been measured for two consecutive years, surveys shall be conducted once every five years.
Perimeter Fence, Gates, Locks & Signs	General Site Inspection Checklist	Semi-Annual
Access Road	General Site Inspection Checklist	Semi-Annual
Groundwater Monitoring System	Annual Post-Closure Report	Biennial
Well monuments (damage, oxidation)	General Site Inspection Checklist	Semi-Annual
Exposed well casing (structural integrity, cracks, & corrosion) and well caps. Well id markers, surface pads, and dedicated wells.	General Site Inspection Checklist	Semi-Annual
Emergency Response (earthquake, storms, fire)	Emergency Response Inspection Checklist	As soon as possible after an earthquake or heavy storm

8.1.5. Inspection Follow-Up

All copies of completed site inspection checklists (Appendix A) will be forwarded to the Dugway Environmental Office. If significant damage or erosion is observed, the Dugway Environmental Office will be contacted immediately by telephone. The Point-of-Contact for the Dugway Environmental Office is as follows:

Mr. Scott Reed
Dugway Environmental program Office
Dugway Proving Ground, UT 84022
(435) 831-3592

The Dugway Environmental Office will notify the appropriate personnel to implement corrective action as needed.

8.2. Reporting

This section summarizes the reporting requirements for HWMU 2 during the post-closure period (Table 8-3).

8.2.1. Non-Compliance

In the event a non-compliant issue is observed at HWMU 2, which may endanger public water supplies, human health, or the environment, the Dugway Environmental Office shall be notified immediately. Dugway will notify the Executive Secretary orally within 24 hours. A written notification will be submitted to UDEQ-DSHW within 5 days after oral notification with a planned corrective action or within 15 days if the Executive Secretary waives the 5-day notification. If the non-compliance does not affect human health or the environment, the written notification will be submitted at the time monitoring reports are submitted (UAC R315-3.1(l)(10). At a minimum, the following information will be provided:

1. Name, address, and telephone number of the Permittee;
2. Name, address, and telephone number of individual making the report;
3. Date, time, and type of incident;
4. Description and quantity of materials involved;
5. The extent of injuries or damage (if any);
6. An assessment of actual or potential hazard to the environment and health outside the facility; and
7. Estimated quantity and disposition of recovered materials.

The remote site conditions at HWMU 2 are such that impacts to human health outside the site itself are very unlikely. HWMU 2 is located in a very remote part of a controlled federal facility. Hazardous materials are no longer managed or maintained at the site. Nonetheless, if there is any type of non-compliance, the above requirements apply.

Table 8-3: Summary Table of Required Submittals

Required Submittals	Frequency and Submittal Date
Biennial Post-Closure Report	Post Closure Reports shall be submitted to the DSHW no later than March 1st, of the following year, that the report is due. Reporting years are odd numbered years beginning with 2005, for the duration of the Post-Closure Monitoring Period.
Annual Post-Closure Groundwater Report	Post Closure Reports shall be submitted to the DSHW no later than March 1st, of the year when the report is due
Anticipated Non-Compliance (Module VII.C.5).	30 days advance notice of any change, which may result in non-compliance.
24-hour Notification on information concerning the non-compliance, which may endanger public drinking water supplies or human health or the environment (Module VII.C.5.).	Orally within 24 hours of discovery noncompliance.
Five-day written notification on information concerning the non-compliance, which may endanger public drinking water supplies or human health or the environment. The Executive Secretary may waive the 5-day notice, in favor of a 15-day notice (Module VII.C.5.).	Within 5 days of discovery
Written notification on information concerning the non-compliance, which does not endanger human health or the environment (Module VII.C.5.).	Submitted with the Biannual Post Closure Report are submitted.

8.3. Post-Closure Reporting

Two reports will be required during post-closure care: an Annual Post-Closure Groundwater Report and a Biennial Post-Closure Report. Post Closure Reports shall be submitted to DSHW no later then March 1st, of the following year, that the report is due. The first Post-Closure reporting year is 2005 for HWMU 2. The report shall be submitted

no later than March 1st of 2006.The following describes the minimum information covered in each report.

8.3.1 Biennial Post-Closure Report

In accordance with R315-3-3.1(l)((9), a Biennial Post-Closure Report will be prepared for all Dugway closed HWMUs and SWMUs undergoing post-closure care. Specifically for HWMU 2, the Biennial Post-Closure Report will include the following:

1. General site description and conditions;
2. Inspection records;
3. Settlement marker readings;
4. Notification procedures; and
5. Maintenance/Repairs performed.

8.3.2 Annual Post-Closure Groundwater Report

In accordance with 40 CFR 265.94(a)(2), an Annual Post-Closure Groundwater Report will be submitted for all HWMUs and SWMUs undergoing post-closure groundwater monitoring. The report will include the following:

1. Groundwater sampling results;
2. Any changes in trends or notable observations in the data;
3. Data quality assessment;
4. IDW management; and
5. Recommendations.

However, since HWMU 2 will only be sampled on a biennial basis, reporting of groundwater data for HWMU 2 will only be on a biennial basis. Where HWMUs or SWMUs undergo post-closure groundwater monitoring on a more frequent basis, the Post-Closure Groundwater Report will be submitted annually.

The Annual Post-Closure Groundwater Report shall be submitted to the Executive Secretary no later than March 1st, of the following year, that the report is due. The first Post-Closure reporting year is 2005 for HWMU 2. The report shall be submitted no later than March 1st of 2006.

Reporting will be required during the entire post-closure period and end when the post-closure period is completed.

9.0. POST-CLOSURE CERTIFICATION

No later than 60 days after post-closure activities are completed and approved by the Executive Secretary, Dugway will submit a certification to the Board, signed by Dugway and an independent professional engineer registered in the State of Utah, stating why post-closure care is no longer needed.

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DUGWAY PERMIT

MODULE VII

ATTACHMENT 3

APPENDIX A

HWMU 2
INSPECTION CHECKLISTS (3)

GENERAL SITE INSPECTION CHECKLIST
HWMU 2 Waste Pile at North End of Granite Peak
Dugway Proving Ground, Utah
Post-Closure Plan

1. Does the soil cap appear to be disturbed or damaged?

☐ Yes
☐ No

Comments: _____

2. Are there open holes in the soil that may be caused by burrowing animals?

☐ Yes *
☐ No

**If yes, fill up the hole with clean soil*

Comments: _____

3. Are there noticeable depressions or ponding of surface water on the landfill cover?

☐ Yes *
☐ No

**If yes, backfill the depression with the soil type described in Appendix B of the Post-Closure Plan. Where soil erosion seems excessive and continual, corrective action may be needed (contact Dugway Environmental Office immediately [same business day]).*

Comments: _____

4. Are there large (more than 2 inches wide) cracks or rills in the soil cover?

☐ Yes *
☐ No

* If yes, notify the Dugway Environmental Office immediately (same business day). Note the orientation, location, and frequency of cracks, and photograph areas of concern, if possible.

Comments: _____

5. Have any trees or shrubs grown on the landfill cover?

☐ Yes *
☐ No

** If yes, remove the tree(s) or shrub(s).*

Comments: _____

6. Is there excessive vegetation (large stalks that would impede surface water flow) in the swale (drainage ditch)?

☐ Yes *

☐ No

** If yes, remove the vegetation.*

Comments: _____

7. Are posted signs in place at least every 50 feet along the fence and in good condition (legible)?

☐ Yes

☐ No *

* If no, mark location(s) of damaged or missing signs and notify the Dugway Environmental Office immediately (same business day) for repairs or replacements.

Comments: _____

8. Is the landfill adequately secured by a perimeter fence in good condition? Is the lock still in-place and undamaged?

☐ Yes

☐ No *

* If no, secure (with locks obtained from the Dugway Environmental Office) perimeter fence. If the fence is damaged, mark location of damage and notify the Dugway Environmental Office immediately (same business day) for repairs.

Comments: _____

9. Inspect areas that channel water runoff at the site, including ditches and slope edges. Are there signs of excessive erosion (rutting 1-foot wide by 1-foot deep) from storm water runoff?

☐ Yes *

☐ No

** If yes, notify the Dugway Environmental Office immediately (same business day) to determine the appropriate course of action for repair.*

Comments: _____

10. Inspect the all-weather access road leading to and around the HWMU 2 site. Are there significant potholes and/or erosion?

☐ Yes *

☐ No

** If yes, notify the Dugway Environmental Office immediately (same business day) to determine the appropriate course of action for repair.*

Comments: _____

11. Inspect the settlement monuments. Are they intact and legible?

☐ Yes

☐ No *

** If no, notify the Dugway Environmental Office immediately (same business day) to determine the appropriate course of action for repair.*

Comments: _____

12. Inspect the four monitoring wells. Is there any damage to the above-ground casing, cement apron, annulus, locks, and well caps?

☐ Yes *

☐ No

** If yes, notify the Dugway Environmental Office immediately (same business day) to determine the appropriate course of action for repair.*

Comments: _____

Additional Notes ***(Time, temperature, wind direction, and other observations)***

_____

_____

_____

_____

_____

_____

_____

_____

_____
Name of Inspector

_____
Company

_____ _____
Signature of Inspector Time and Date of Inspection

VEGETATIVE COVER INSPECTION CHECKLIST
HWMU 2 Waste Pile at North End of Granite Peak
Dugway Proving Ground, Utah
Post-Closure Plan

1. Are there areas of stressed or missing vegetation on landfill cover?

☐ Yes *

☐ No

** If yes, re-establish vegetative growth by watering or reseeding in accordance with Appendix B (HWMU 2 Closure Report), of this Post-Closure Plan. Seeding should take place during the season that will optimize establishment of vegetation.*

Comments: _____

2. Are there known areas of continual poor growth despite reseeding efforts?

☐ Yes *

☐ No

* If yes and the areas appears to be affecting the integrity of the soil cover, contact the Dugway Environmental Office immediately (same business day).

Comments: _____

3. Have invasive or deep-rooting species that may penetrate the cap taken root on the cap soil cover?

☐ Yes *

☐ No

Invasive species in this area include cheat grass.

* If yes, identify the affected area and observed plant species, develop a strategy to remove the invasive plants (permanently if possible), and make recommendations to the Dugway Environmental Office. One recommended approach is to spot spray the species with an herbicide; this approach may take up to 4 days, depending on the extent of removal. Roots can also be cut out. Inspect the area every 2 weeks following removal to ensure that invasive species have not returned.

Comments: _____

Additional Notes ***(Time, temperature, wind direction, and other observations)***

_____

_____

_____

Additional Notes ***(Time, temperature, wind direction, and other observations) (Continued)***

_____

_____

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_____

_____
Name of Inspector

_____
Company

_____ _____
Signature of Inspector Time and Date of Inspection

EMERGENCY RESPONSE INSPECTION CHECKLIST
HWMU 2 Waste Pile at North End of Granite Peak
Dugway Proving Ground, Utah
Post-Closure Plan

1. Are there large (more than 2 inches in width) cracks in the soil cover?

☐ Yes *

☐ No

* If yes, notify the Dugway Environmental Office immediately (same business day) to determine whether the cracks are due to desiccation or slope failure.

Comments: _____

2. Are there notable depressions or ponding of surface water on the landfill cover?

☐ Yes *

☐ No

** If yes, backfill depression with soil type described in Appendix B (HWMU 2 Closure Report) to restore grade of cap, as shown on Figure 2-4. Where soil erosion seems excessive and continual, corrective action may be needed (contact the Dugway Environmental Office).*

Comments: _____

3. Are posted signs in place and in good condition (legible)?

☐ Yes

☐ No *

* If no, document location(s) of damaged or missing signs and notify the Dugway Environmental Office immediately (same business day) for repairs or replacements.

Comments: _____

4. Do the settlement markers indicate any significant horizontal or vertical movement? See Figure 2-4 of the Post-Closure Plan.

☐ Yes *

☐ No

* If yes, contact the Dugway Environmental Office immediately (same business day) to arrange resurveying to establish magnitude of movement.

Comments: _____

Additional Notes ***(Time, temperature, wind direction, and other observations)***

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____
Name of Inspector

_____
Company

_____ _____
Signature of Inspector Time and Date of Inspection

DUGWAY PERMIT

MODULE VII

ATTACHMENT 3

APPENDIX B

HWMU 2

CERTIFICATION OF CLOSURE

CERTIFICATION OF CLOSURE

This Certification of Closure for Hazardous Waste Management Unit (HWMU) 2 at Dugway Proving Ground, Utah has been prepared by Shaw in accordance with the state-approved Remedial Action Plan for HWMU 2 Waste Pile at the North End of Granite Peak, Final and the 100% Design Report Soil Cover System for HWMU 2 Waste Pile at the North End of Granite Peak, Revision 0, and the closure requirements specified under the Utah Administrative Code (UAC) 315-3, 315-7-14, 315-7-21, 315-302-3, and 40 Code of Federal Regulations 265, Subpart G for closure of HWMU 2.

The signature and seal certify that a licensed professional has prepared or reviewed the Closure Report in accordance with the above referenced regulatory requirements.

Respectfully submitted,
Shaw Environmental, Inc.

Adam S. Ng, Ph.D., P.E.
Senior Civil Engineer
Utah Registered Civil Engineer No. 4858945-2202 (Expires 12/31/2004)

4/11/03

DUGWAY PERMIT

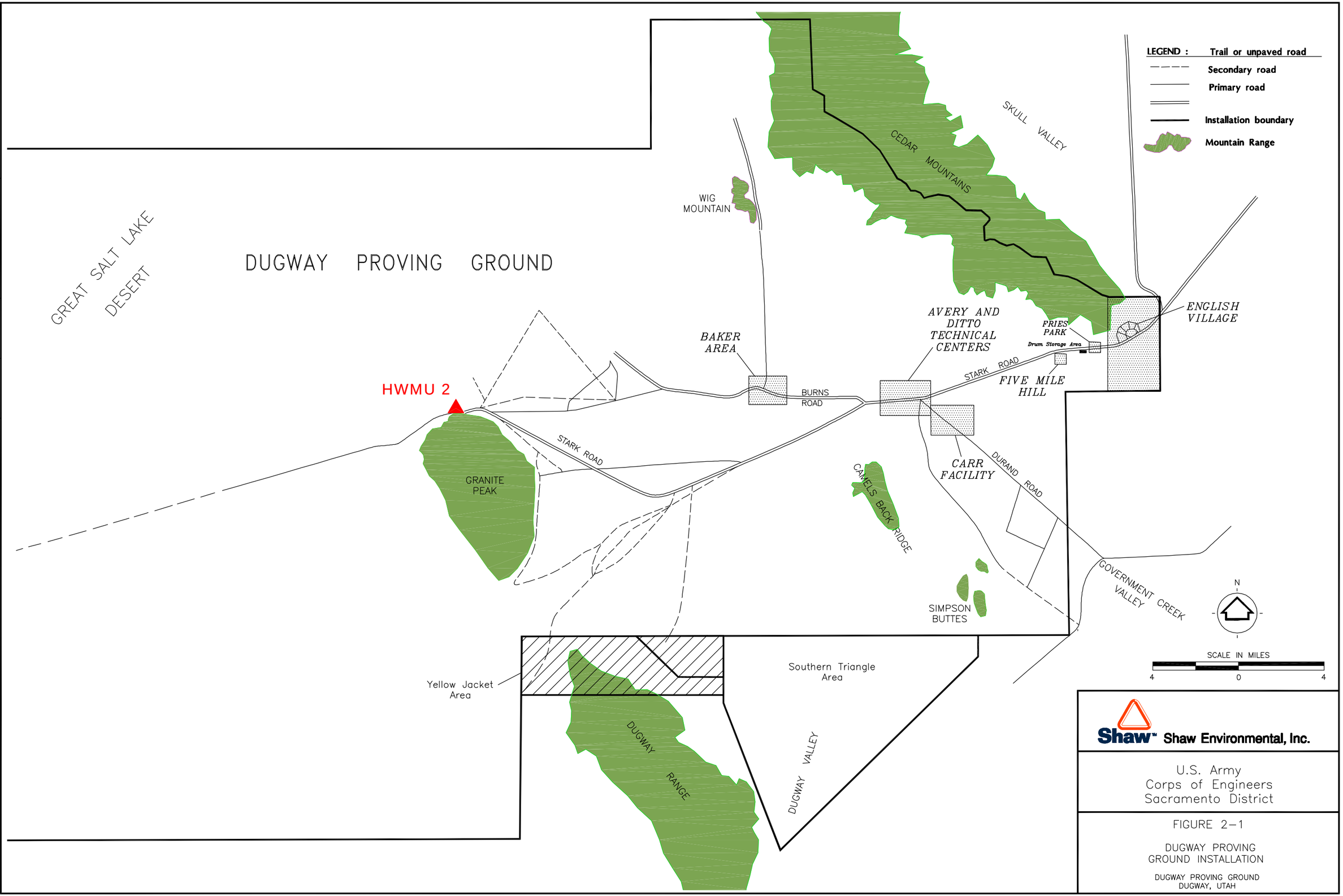
MODULE VII

ATTACHMENT 3

HWMU 2

FIGURES

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE	X-REF	IMAGE
870502-B461	S. KISHNANI 2/3/03	D. SANCHEZ 2/3/03	M. Verhaeg 03/05/03	Concord	---	---



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U.S. Army
Corps of Engineers
Sacramento District

FIGURE 2-1

DUGWAY PROVING GROUND INSTALLATION

DUGWAY PROVING GROUND
DUGWAY, UTAH

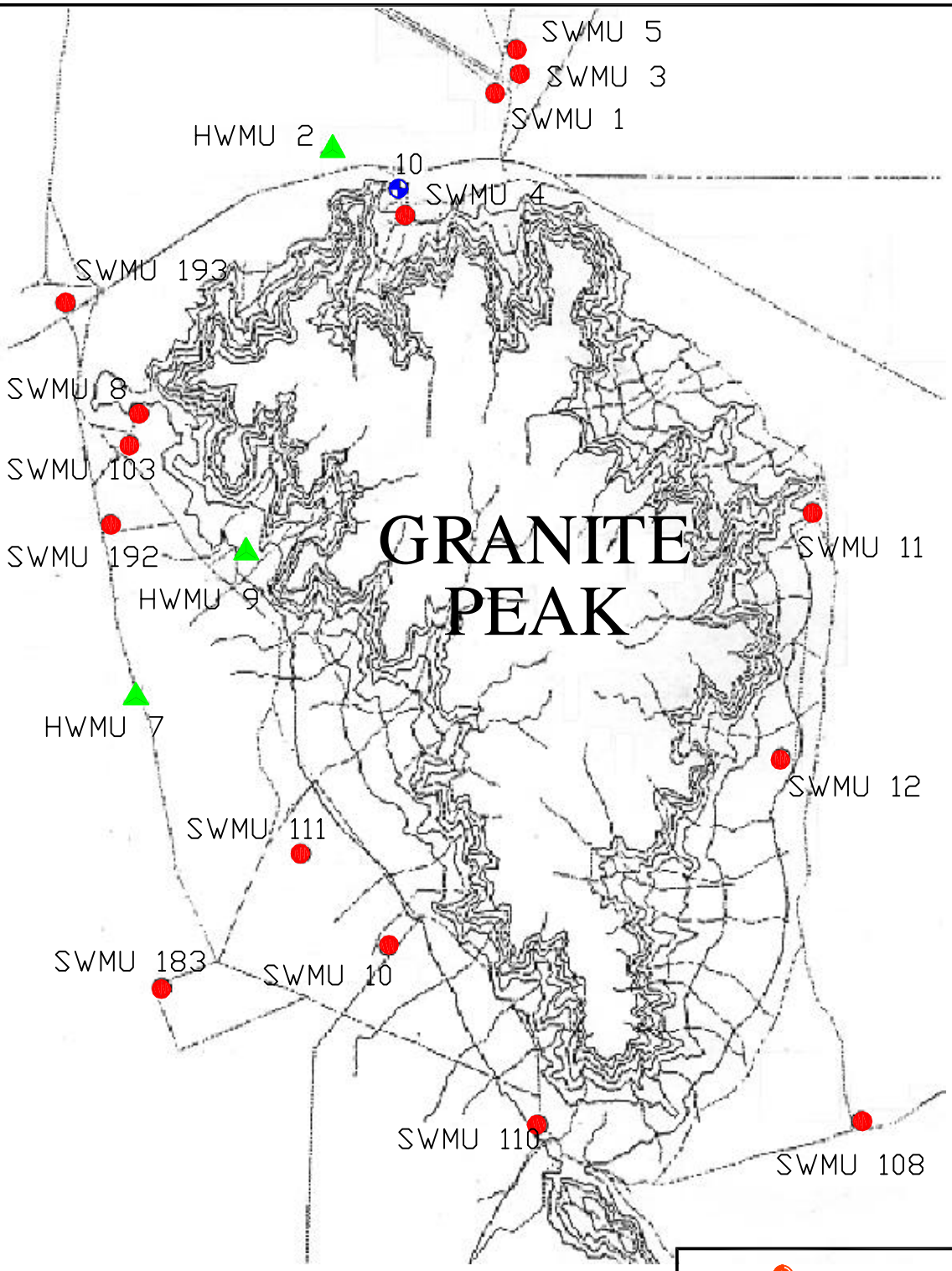


IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	Concord	R. LANGSTON	11/6/2002	D. SANCHEZ	2/3/03	S. KISHNANI		870502-A197

LEGEND

- Consent Order HWMU
- Corrective Action SWMU
- Water Supply Well

N

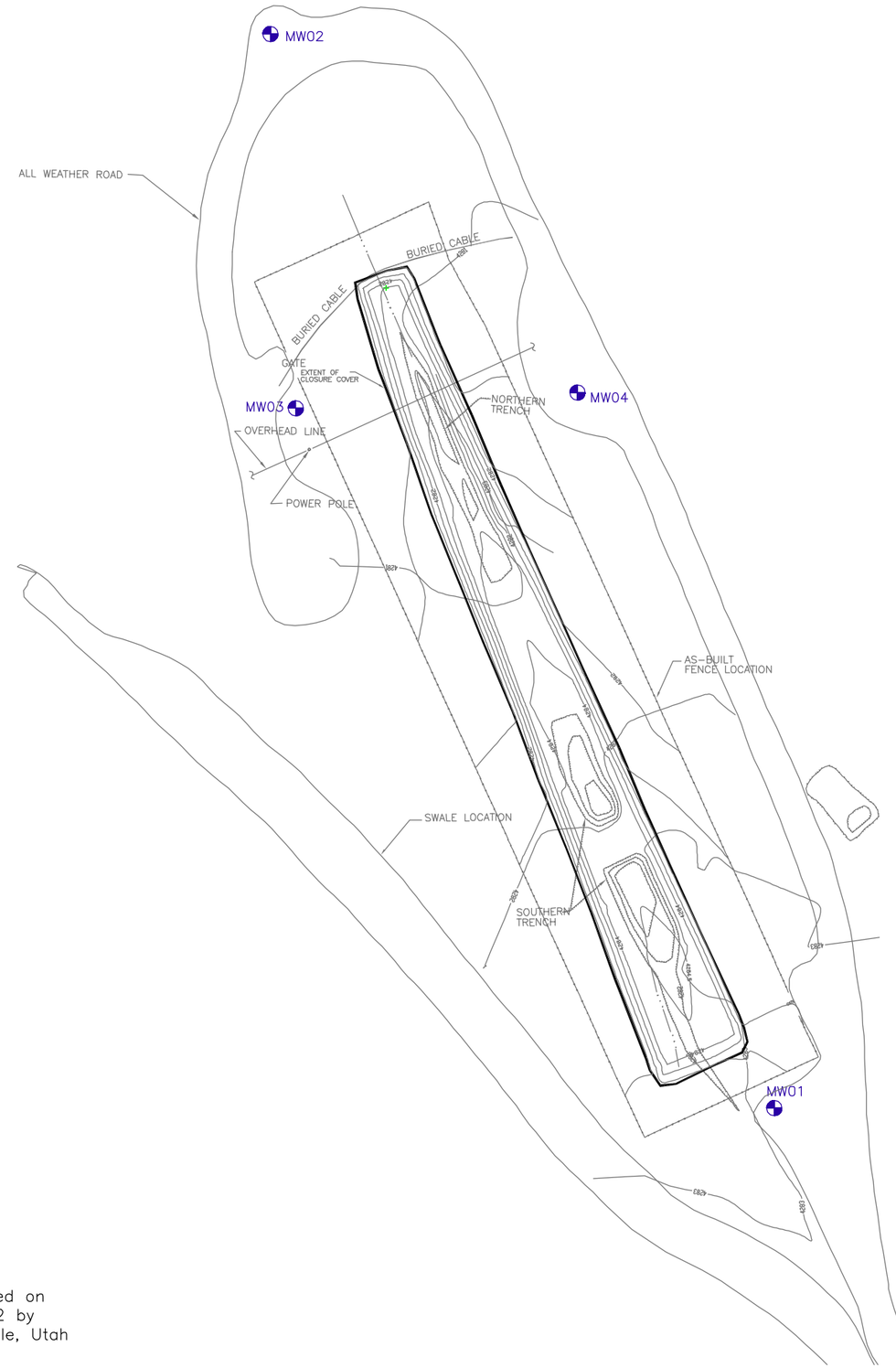
Shaw Environmental, Inc.

U.S. Army
Corps of Engineers
Sacramento District

FIGURE 2-2
HWMU 2
LOCATION MAP

DUGWAY PROVING GROUND
DUGWAY, UTAH

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	Concord	R. LANGSTON 4/4/2003	D. LANDON 5/5/03	T. SEARLS 5/5/03	870502-B460



Reference: Topography shown is based on As-built survey completed June 2002 by Thompson-Hysell Engineers, Taylorsville, Utah

LEGEND

Monitoring Well

N

SCALE IN FEET

0 60 ft.

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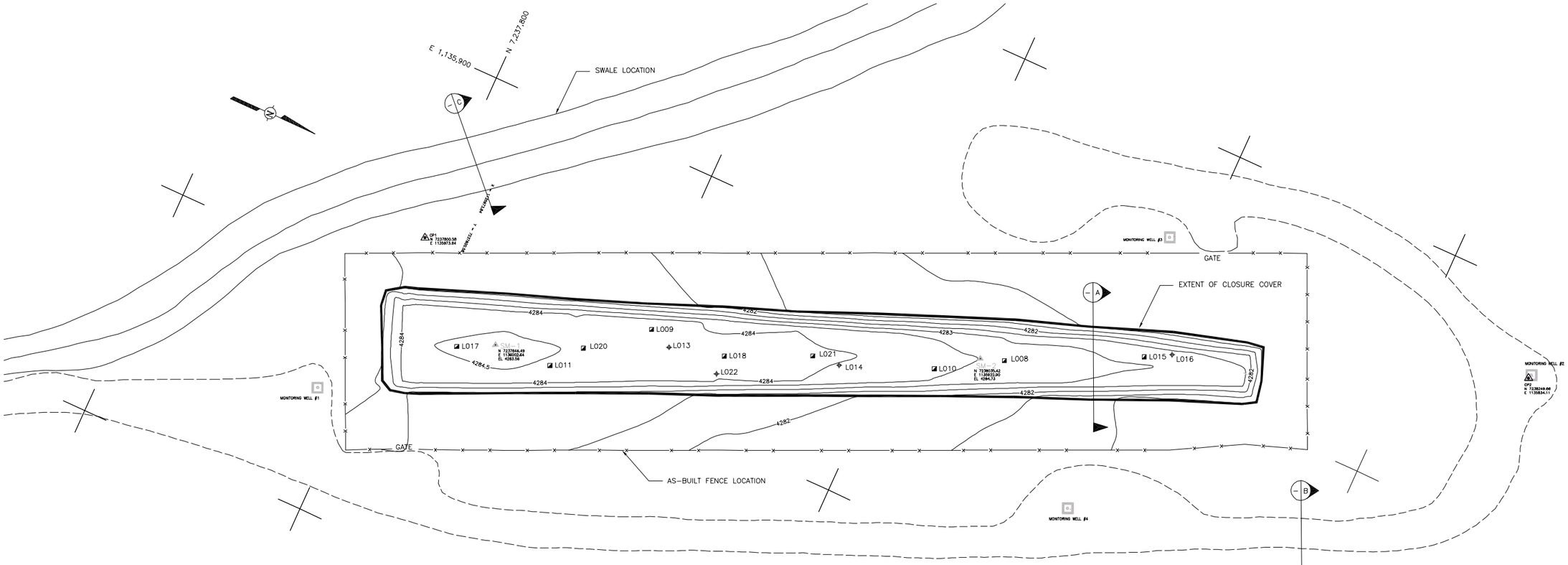
Corps of Engineers
Sacramento District

FIGURE 2-3
HWMU 2
LANDFILL
POST-CLOSURE MONITORING WELLS

DUGWAY PROVING GROUND
DUGWAY, UTAH

IMAGE	X-REF	OFFICE	DRAWING NUMBER
---	---	CONC	870502-D34

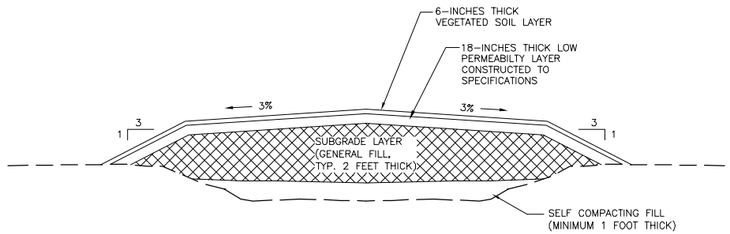


LEGEND

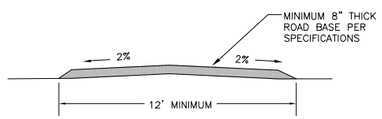
- FENCE
- FINAL GRADE
- ALL WEATHER ROAD
- PASSING PERMEABILITY TEST LOCATIONS
- LOCATION OF NUCLEAR GAUGE TESTS
- SETTLEMENT MONUMENTS
- MONITORING WELL LOCATION

TEST LOCATION	NORTHING (FT.)	EASTING (FT.)	LIFT NUMBER
L022	7237936.58	1135974.96	1
L013	7237913.65	1135973.11	1
L014	7237982.25	1135950.15	2
L016	7238108.48	1135887.69	3
L022	7237936.58	1135974.96	1
L008	7238044.99	1135919.44	1
L009	7237903.80	1135969.38	2
L010	7238019.45	1135934.86	2
L011	7237871.04	1136001.03	2
L013	7237913.65	1135973.11	1
L014	7237982.25	1135950.15	2
L015	7238098.14	1135893.42	2
L016	7238108.48	1135887.69	3
L017	7237831.90	1136010.01	3
L018	7237936.48	1135966.80	3
L020	7237880.93	1135988.48	1
L021	7237970.48	1135951.21	1

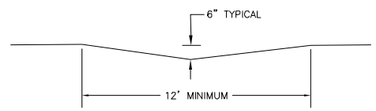
REFERENCE:
AS-BUILT SURVEY COMPLETED JUNE 2002
BY THOMPSON - HYSELL ENGINEERS, TAYLORSVILLE, UTAH



TYPICAL CROSS SECTION A
NOT TO SCALE



TYPICAL ROAD CROSS SECTION B
NOT TO SCALE



TYPICAL SWALE CROSS SECTION C
NOT TO SCALE

Shaw Shaw Environmental, Inc.

U.S. ARMY
CORPS OF ENGINEERS
SACRAMENTO DISTRICT

FIGURE 2-4 HWMU 2 FINAL
POST-CLOSURE CONFIGURATION
DUGWAY PROVING GROUND
DUGWAY, UATH

REV	DATE	BY	CHK'D	APR'VD	DESCRIPTION/ISSUE

DESIGNED BY			CHECKED BY	D. SANCHEZ 3/31/2003
DRAWN BY	SJZ 3/31/2003		APPROVED BY	S. KISHNANI 3/31/2003

SCALE:	DRAWING NO.	SHEET NO.	REVISION NO.
AS SHOWN	870502-D34	-	